भारतीय मानक
Indian Standard

IS 4127 : 2023

कांचाभ स्टोनवेयर पाइप को बिछाना — रीति संहिता

(दूसरा पुनरीक्षण)

Laying of Glazed Stoneware Pipes — Code of Practice

(Second Revision)

ICS 23.040.05; 93.030

© BIS 2023

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

October 2023 **Price Group 8**

Public Health Engineering Sectional Committee, CED 24

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Public Health Engineering Sectional Committee had been approved by the Civil Engineering Divisional Council.

This standard covers laying, handling and jointing of glazed stoneware pipes below ground level for drainage purposes. It also covers tests, backfilling of trenches, and restoration of surfaces.

For all sewers and drains in the ordinary ground, glazed stoneware pipes are recommended in preference to other types of pipes. They are particularly suitable where acidic/corrosive effluents or acidic/corrosive subsoil conditions are likely to be encountered. The laying of glazed stoneware pipes for drainage purposes has been generally governed by the regulations laid down by the various municipalities and municipal corporations. These regulations are intended to ensure the proper laying of pipes, giving due consideration to the economy and safety of workers engaged in pipe laying. However, there is no uniformity in these regulations regarding minimum standards of laying which should be fulfilled for proper and safe laying of stoneware pipes and this code is intended to give the necessary guidance on sound practices of laying stoneware pipes.

This standard was first published in 1967 and subsequently revised in 1983. In the first revision of the standard, improvements found necessary in light of the usage of the standard were incorporated. Also, the quantity of spun yarn to be used in the joints was omitted and the guidance for the depth of yarn to be inserted in the joints was provided.

In this revision of the standard, experience gained over the years in the use of standard has been utilized. Following major modifications have been incorporated:

a) Minimum width of trench for various depths of trenches have been added;
b) Minimum grade of concrete bedding, haunching and surround or encasing has been changed from nominal mix 1 : 4 : 8 to 1 : 3 : 6 or M10 grade concrete;
c) Use of lime concrete as a material for bedding, haunching and surround or encasing has been deleted;
d) In case of deep trench, use of wooden strut has been replaced by prestressed cement concrete (PCC) strut of nominal mix 1 : 3 : 6 or M 10 grade concrete; and
e) Requirement for hydraulic test has been updated by including permissible limits of sweating in 30 min.

The composition of the Committee responsible for the formulation of this standard is given in Annex C.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

LAYING OF GLAZED STONEWARE PIPES — CODE OF PRACTICE

(Second Revision)

1 SCOPE

1.1 This standard covers the methods of laying glazed stoneware pipes below ground level for drainage purposes. It also includes handling and jointing of pipes, tests, backfilling, and restoration of surfaces.

1.2 For the purpose of this standard, stoneware pipes shall be those conforming to IS 651 and IS 3006.

1.3 This standard is only applicable to public sewers and pipes laid down for building drainage in accordance with IS 1742.

2 REFERENCES

The standards given below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standards:

IS No.	*Title*
IS 269 : 2015	Ordinary Portland cement — Specification (*sixth revision*)
IS 455 : 2015	Portland slag cement — Specification (*fifth revision*)
IS 456 : 2000	Plain and reinforced concrete — Code of practice (*fourth revision*)
IS 651 : 2007	Glazed stoneware pipes and fittings — Specification (*sixth revision*)
IS 783 : 1985	Code of practice for laying of concrete pipes (*first revision*)
IS 1200 (Part 1) : 1992	Methods of measurement of building and civil engineering works: Part 1 Earthwork (*fourth revision*)
IS 1489	Portland pozzolana cement — Specification
Part 1 : 2015	Fly ash based (*fourth revision*)
Part 2 : 2015	Calcined clay based (*fourth revision*)
IS 1542 : 1992	Sand for plaster — Specification (*second revision*)
IS 1742 : 1983	Code of practice for building drainage (*second revision*)
IS 2405 (Part 1) : 1980	Specification for industrial sieves — Part 1 Wire cloth sieves (*first revision*)
IS 3006 : 1979	Specification for chemically resistant glazed stoneware pipes and fittings (*first revision*)

3 TERMINOLOGY

For the purpose of this standard, the terminologies given in IS 1742 shall apply.

4 EXCAVATION AND PREPARATION OF TRENCH

4.1 General

The trench shall be so dug that the pipe can be laid to the required alignment and at the required depth. When the pipeline is under a roadway, a minimum cover of 900 mm is recommended for adoption, but it may be modified to suit local conditions. The trench shall be excavated only so far in advance of pipe laying as specified by the authority. The trench shall be so shored and drained that the workmen may work therein safely and efficiently. The discharge of the trench dewatering pumps shall be conveyed either to drainage channels or to natural drains.

4.1.1 *Trenching*

The excavation should be carried out with manual labour or with suitable mechanical equipment as approved by the authority.

4.2 Width of Trenches

Unless otherwise specified by the authority, the width at bottom of trenches for different diameters of pipes laid at different depths shall be as given below:

a) For all diameters, up to an average depth of 1 200 mm, width of trench, in mm = diameter of pipe + 300 mm.

b) For all diameters for depths above 1 200 mm, width of trench, in mm = diameter of pipe + 400 mm.

c) Notwithstanding (a) and (b), the total width of the trench should not be less than the following:

1) 600 mm for depths below 900 mm;

2) 750 mm for depths between 900 mm to 1 200 mm;

3) 900 mm for depths between 1 200 m to 1 800 mm; and

4) 1 000 mm for depths above 1 800 mm.

4.3 Limits of Excavation Relative to Gradients

Except where special foundations are to be provided for the reasons given in **4.5**, the trench shall be excavated in accordance with one of the following alternatives as may be considered appropriate by the authority:

a) The trench shall be excavated to the exact gradient, so that no making of the subgrade by backfilling is required and the concrete bed, where required, may be prepared with the greatest ease giving a uniform and continuous bearing and support for the pipe.

b) When the bottom of the trench at the specified gradient is found to be unstable or includes ashes and cinders, all types of refuse, vegetable or other organic material, or large pieces of fragments of inorganic material, they shall be removed to the satisfaction of the authority. Before laying the concrete bed, where necessary, the specific gradient shall be attained by backfilling with an approved material in uncompacted layers of 80 mm. The layers shall then be tamped as directed by the authority.

The gradient shall be specified in accordance with IS 1742.

4.4 Trimming of Trench Bottoms

The bottom of the trench shall be properly trimmed off to present a plain surface and all irregularities shall be levelled. Where rock and large stone or boulders are encountered the trench shall be trimmed to a depth of at least 80 mm below the level at which the bottom of the barrel of the pipe is to be laid, and filled to a like depth with stones broken to pass through a sieve of 12.5 mm aperture size [*see* IS 2405 (Part 1)] and well rammed to form a firm bed for pipes. Excavation shall be at joints to such dimensions as will allow the joints to be conveniently and thoroughly filled.

4.5 Special Foundation in Poor Soil

Where the bottom of the trench at sub-grade is found to consist of material which is unstable to such a degree that, in the opinion of the authority, it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, a suitable foundation for the pipe, consisting of piling, timbers and other materials, in accordance with plans prepared by the authority shall be constructed.

4.6 Rock Excavation

The term ‘Rock’ wherever used in this standard shall have the same meaning as given in **3.1** of IS 1200 (Part 1).

4.7 Blasting

Blasting for excavation in rock shall be permitted only after securing the approval of the authority and only when proper precautions are taken for the protection of persons and property. The hours of blasting shall be fixed by the authority. The procedure of blasting shall conform to the requirements of local controlling authority.

4.8 Braced and Sheeted Trenches

Open-cut trenches shall be sheeted and braced as required by any governing state laws and municipal regulations and as may be necessary to protect life, property and the work. When close sheeting is required, it shall be so driven as to prevent adjacent soil from entering the trench either below or through such sheeting.

4.8.1 The authority shall have the right to order the sheeting to be driven to the full depth of the trench or to such additional depths as may be required for the protection of the work. Where the soil in the lower limits of a trench has the necessary stability,

the authority at its discretion, may permit stopping of the driving of sheeting at some designated elevation above the trench bottom.

4.8.2 Sheeting and bracing which have been ordered left in place should be removed for a distance of 0.9 m below the established street level or the existing surface of the street, whichever is lower. Trench bracing, except that which has been left in place, may be removed when the backfilling has reached the respective level of such bracing. Sheeting, except that which has been left in place, may be removed after the backfilling has been completed or has been brought up to such an elevation as to permit its safe removal. Sheeting and bracing may be removed before filling the trench, but only in such a manner as will ensure the adequate protection of the completed work and adjacent structures.

4.9 Care of Surface Material for Re-use

All surface materials which, in the opinion of the Authority, are suitable for re-use in restoring the surface shall be kept separate from the general excavation material as directed by the authority.

4.10 Stacking Excavated Material

All excavated material shall be stacked in such a manner that it will not endanger the work and it will avoid obstructing footpaths and roads. Hydrants under pressure, surface boxes, fire or other utility controls shall be left unobstructed and accessible until the work is completed. Gutters shall be kept clear or other satisfactory provisions made for street drainage, and natural water-courses shall not be obstructed.

4.11 Barricades, Guards and Safety Provisions

To protect a person from injury and to avoid damage to property, adequate barricades, construction signs, torches, red lanterns and guards, as required, shall be placed and maintained during the progress of the construction work and until it is safe for traffic to use the roadway. All materials, piles, equipment and pipe which may serve as obstructions to traffic shall be enclosed by fences for barricades and shall be protected by proper lights when the visibility is poor. The rules and regulations of the local authorities regarding safety provisions shall be observed.

4.12 Maintenance of Traffic and Closing of Streets

The work shall be carried out in such a manner which will cause the least interruption to traffic, and the road or street may be closed in such a manner that it causes the least interruption to the traffic. Where it is necessary for traffic to cross open trenches, suitable bridges shall be provided.

Suitable signs indicating that a street is closed shall be placed and necessary detour signs for the proper maintenance of traffic shall be provided.

4.13 Structure Protection

Temporary support, adequate protection and maintenance of all underground and surface structures, drains, sewers and other obstructions encountered in the progress of the work shall be provided under the direction of the authority. The structures which may have been disturbed shall be restored upon completion of the work.

4.14 Protection of Property and Surface Structures

Trees, shrubbery fences, poles and all other property and surface structures shall be protected unless their removal is shown on the drawings or authorized by the authority. When it is necessary to cut roots and tree branches, such cutting shall be done under the supervision and direction of the authority.

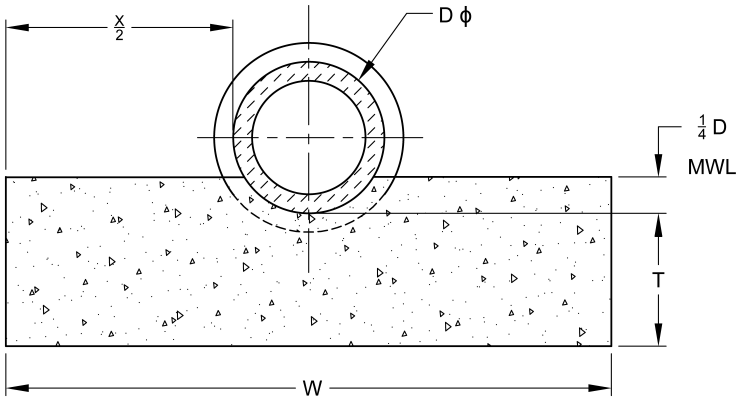
4.15 Interruption of Service

No valve or other control of the existing services shall be operated without the permission of the authority.

5 BED CONCRETE

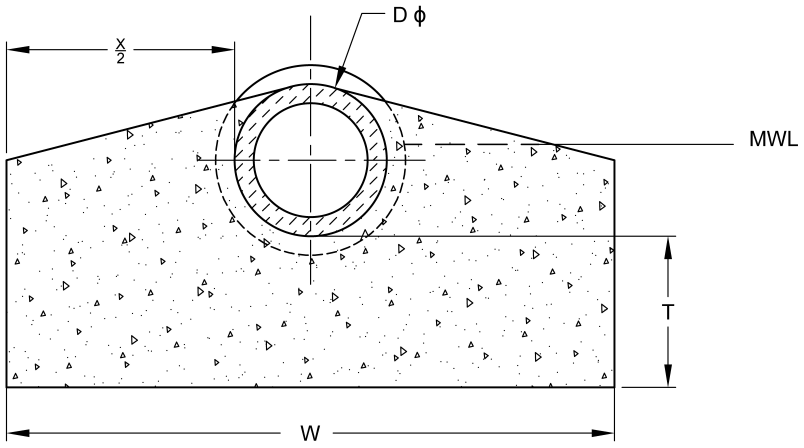
5.1 Bedding

Where the pipes are laid on a soft soil with the maximum water table level, lying at the invert level of the pipe, the pipe shall be bedded in concrete (*see* Fig. 1). Alternatively, precast concrete sleepers at suitable intervals with 90° contact may be used if approved by the Authority when the pipes are to be laid over swelling soil; sand filling cushion of suitable thickness may be provided.



W = *D* + *X*, where *D* is the external diameter of the pipe
X = 300 mm, up to trench depth of 1.20 m
400 mm, trench depth more than 1.20 m
T = 100 mm for pipes under 150 mm nominal diameter;
one fourth of internal diameter subject to a minimum of 150 mm
and maximum of 300 mm for pipes of more than 150 mm diameter
MWL = Maximum water level.

FIG. 1 BEDDING



W = *D* + *X*, where *D* is the external diameter of the pipe
X = 300 mm, up to trench depth of 1.20 m
400 mm, trench depth more than 1.20 m
T = 100 mm for pipes under 150 mm nominal diameter;
one fourth of internal diameter subject to a minimum of 150 mm
and maximum of 300 mm for pipes of more than 150 mm diameter
MWL = Maximum water level.

FIG. 2 HAUNCHING

5.2 Haunching

Where the pipes have to be laid in a soft soil with the maximum water table level rising above the invert level of the pipe, but below the top of the barrel, the pipe sewers shall be haunched (*see* Fig. 2).

5.3 Surrounding or Encasing of Pipes

In the following cases, the pipes shall be completely encased or surrounded with concrete (*see* Fig. 3):

a) Where the maximum water table level is likely to rise above the top of the barrel;

b) Where the sewers are to be laid adjacent to growing trees, to avoid damage to the pipe likely to be caused by the roots of the trees;

c) Where the depth of the pipe is less than 1.2 m under the road surface; and

d) Whenever the intensity of loading on pipes exceeds the limits given in Annex A.

5.4 Materials

The concreting whenever necessary shall be done with minimum 1 : 3 : 6 or M10 grade cement concrete as per IS 456 (when the sub-soil conditions permit the same). The dimension of concreting shall be as shown in Fig. 1, 2 and 3.

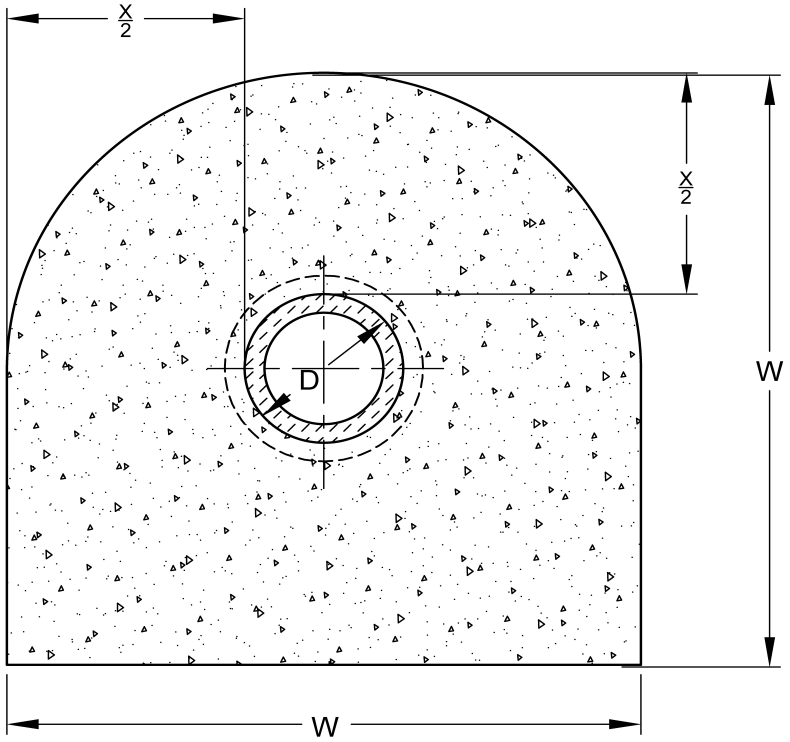
6 LAYING

6.1 General

Since the external drainage piping gets covered underground, it is to be programmed in segments so that each part gets properly laid, inspected, tested and covered.

6.2 Unloading of Pipes

While unloading, pipes shall not be thrown down from the trucks on hard ground. Unloading them on timber skids without a steadying rope and thus allowing the pipes to bump hard against one another



W = $D + X$, where D is the external diameter of the pipe
X = 300 mm, up to trench depth of 1.20 m
400 mm, trench depth more than 1.20 m
T = 100 mm for pipes under 150 mm nominal diameter;
one fourth of internal diameter subject to a minimum of 150 mm and maximum of 300 mm for pipes of more than 150 mm diameter

FIG. 3 SURROUND OR ENCASING

should not be allowed. In order to avoid damage to the pipes and especially to the spigot end, pipes should not be dragged along concrete and similar pavements with hard surfaces.

6.3 Handling of Stoneware Pipes into Trench

In shallow trenches manual handling is enough, but in deep trenches they should be lowered into the trench by means of ropes. Under no circumstances shall pipes be dropped or dumped into the trench.

6.4 Detection of Cracks in Pipes and Fittings

The pipe and fittings shall be inspected for defects, and be rung with a light hammer preferably while suspended to detect cracks.

6.5 Cleaning Pipes and Fittings

All lumps, blisters and excess coating materials shall be removed gently from the socket and spigot end of each pipe and the outside of the spigot and the inside of the socket shall be wiped clean and dry before the pipe is laid.

6.6 Placing the Pipes in Trench

Every precaution shall be taken to prevent foreign materials from entering the pipes when it is being placed in the line. Normally the socket ends should face the upstream. When the line runs uphill, the socket ends should face the up-grade.

6.6.1 After placing a length of pipe in the trench on concrete bedding where that is specified, the spigot end shall be centred in the socket and the pipe forced home and aligned to the gradient. The pipe shall be secured in place with approved backfill material or concrete tamped under it except at the socket. Pipe and fittings which do not allow a sufficient and uniform space for joints shall be removed and replaced with pipe and fittings of proper dimensions to ensure such uniform space. Precautions shall be taken to prevent dirt from entering the joint space.

6.6.2 At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or canvas or other means approved by the authority.

6.6.3 Sight rails shall be provided at all changes of directions or gradients at distances of about 30 m along straight lengths. The centre-line shall be marked on each horizontal rail which is fixed at the true level. All inverts shall be laid therefrom with the help of proper boning rods.

6.7 Cutting of Pipes

The cutting of pipe for inserting, fitting or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or cement lining so as to leave a smooth end at right angles to the axis of the pipe.

6.8 Pipelines Crossing Railway Lines, Irrigation Channels or Similar Works

The authority should consult the appropriate authorities before preparing plans and specifications for this part of the work.

6.9 Connection to an Existing Sewer

The connection to an existing sewer shall be done through manholes.

6.10 Connections to Manholes

Before connecting a pipe to a manhole, a relieving arch or any other similar protection device should be made in the manhole for the safety of the pipe.

6.11 Strength and Loading of Stoneware Pipes

The pipes, when laid, should not be subjected to superimposed load beyond their safe crushing strength and some guidance in this regard is given in Annex A.

7 JOINTING OF PIPE

7.1 Types of Joints

The stoneware pipes shall be cement jointed or provided with bituminous joints as approved by the Authority.

7.1.1 *Materials and Jointing Procedure for Cement Joints*

7.1.1.1 *Materials*

The materials shall consist of the following**:**

a) Spun yarn or tarred gaskets;

b) Cement [*see* IS 269, IS 455 or IS 1489 (Parts 1 and 2)]; and

c) Sand (*see* IS 1542).

7.1.1.2 *Jointing procedure*

The procedure as given below shall be followed:

a) Caulking of yarn or gasket

In each joint, spun yarn soaked in neat cement slurry or tarred gasket shall be passed round the joint and inserted in it by means of a caulking tool. More skeins of yarn or gasket shall be added if necessary and shall be well caulked. Yarn or gasket so rammed shall not occupy more than one-fourth of the depth of socket.

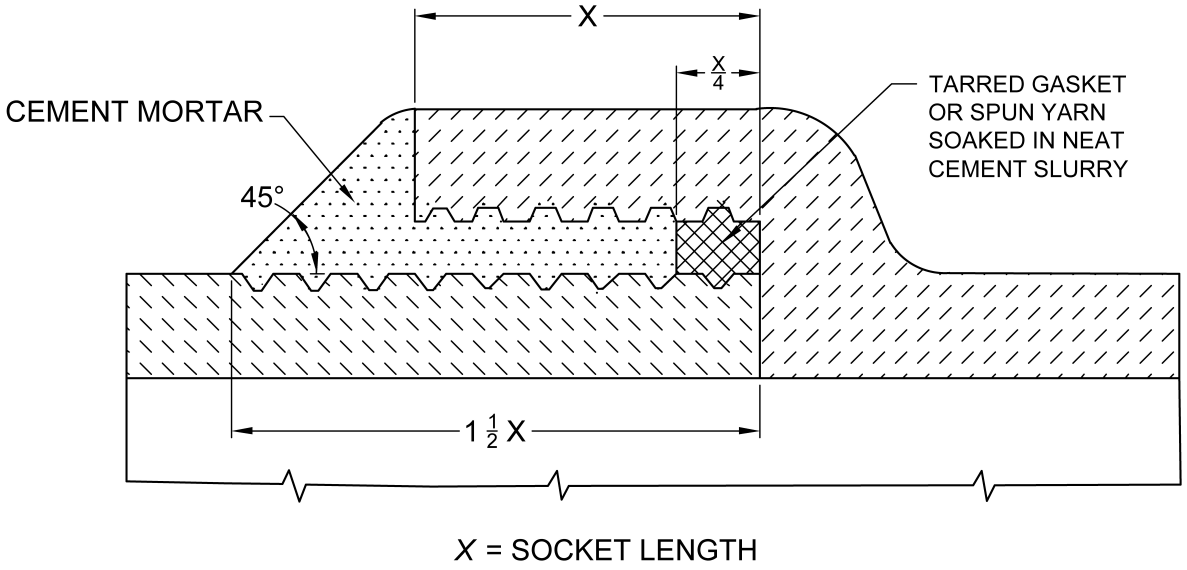


FIG. 4 TYPICAL DETAILS OF CEMENT JOINTS FOR GLAZED STONEWARE PIPES

b) Caulking of cement mortar

Cement mortar (1 : 1) (one part of cement to one part of sand) shall be slightly moistened and carefully inserted by hand into the remaining space of the joint after caulking of yarn or gasket. The mortar shall then be caulked into the joint with a caulking tool. More cement mortar shall be added until the space of joint has been completely filled with tightly caulked mortar. The joint shall then be finished off neatly outside the socket at an angle of 45° as shown in Fig. 4.

c) Curing

The cement mortar joints shall be cured at least for seven days before testing.

d) The approximate quality of cement required for each joint for certain common sizes of pipes are given below for guidance:

Sl No.	*Nominal Diameter of Pipe* mm	*Cement* kg
(1)	(2)	(3)
i)	100	1.0
ii)	150	1.5
iii)	200	2.0
iv)	250	2.5
v)	300	3.25
vi)	350	4.5
vii)	400	5.5

7.1.3 *Materials and Jointing Procedure for Bituminous Joints*

The materials shall consist of a composition of asphalt and sand in the ratio of 1 : 7. Asphalt and sand shall be boiled together and filled into the socket in a molten state with the aid of special moulds.

7.2 Jointing with Cast Iron Pipes

Where any cast iron soil pipe, waste pipe, ventilating pipe or trap is connected with a stoneware pipe or drain connecting with a sewer, the joint shall be made with cement joints (*see* **7.1.1**).

7.3 Jointing with Concrete Pipes

The procedure shall be the same as described for cement joints (*see* **7.1.1**) but the socket or the spigot shall be thoroughly wetted before the joints are made.

8 HYDRAULIC TEST

8.1 Test Pressure

All pipelines shall be subjected to a test pressure of at least 2.5 m head of water at the highest point of the section under test. The tolerance of two litres per centimetre of diameter per kilometre may be allowed during a period of 10 min. The pipeline shall be tested three days after the cement mortar joints have been made.

8.2 Before commencing the hydraulic test, the pipelines shall be filled with water and maintained full for 24 h by adding water, if necessary, under a

head of 0.6 m of water. The test shall be carried outby suitably plugging the low end of the drain and the ends of connections, if any, and filling the system with water. A knuckle bend shall be temporarily jointed-in at the top end and a sufficient length of vertical pipe jointed to it so as to provide the required test head; or the top end may be plugged with a connection to a hose ending in a funnel which could be raised or lowered till the required head is obtained and fixed suitably for observation. A typical arrangement for hydraulic test is given in Annex B.

Subsidence of the water may be due to one or more of the following causes:

a) Absorption of water by pipes and/or joints;
b) Sweating of pipes and/or joints;
c) Leakage at joints or from defective pipes; and
d) Entrapped air.

Allowance shall be made for (a) by adding water until absorption has ceased and after which the proper test should commence. In case of any visible leakage, the defective part of the work should be cut out and made good. A slight amount of sweating which is uniform and less than the permissible leakage in 30 min as given below, may be overlooked:

1) 0.05 l/min for 100 mm pipe
2) 0.08 l/min 150 mm pipe
3) 0.12 l/min for 200 mm pipe
4) 0.16 l/min for 250 mm pipe

If the sweating/leakage is more than those specified above, the water shall be drained off and joints remade as per **8.3** and the piping shall be retested.

8.3 Rectification of Faulty Joints

Any joint found leaking or sweating, shall be rectified or embedded into 150 mm layer of 1 : 2 : 4 or M 20 grade cement concrete as per IS 456, 300 mm in length, and the section retested.

9 BACKFILLING

Refilling shall be done with the finest selected material and shall be done in layers not exceeding 250 mm thick, watered, consolidated and rammed properly as specified.

9.1 Starting of Backfilling

Filling of the trench shall not be commenced until the length of pipes laid has been tested and passed.

9.2 Trench Zoning

For the purpose of backfilling, the depth of the trench shall be considered as divided into the following three zones from the bottom of the trench to its top:

Zone A — From the bottom of the trench or top of the concrete, when concrete bedding is provided, to the level of the centre-line of the pipe.

Zone B — From the level of the centre-line of the pipe to a level 300 mm above the top of the pipe.

Zone C — From a level 300 mm above the top of the pipe to the top of the trench.

9.3 Backfill Material

All backfill material shall be free from cinder, ash, slag, refuse, rubbish, vegetable or organic material, lumpy or frozen material, boulders, rocks or stone or other material which in the opinion of the Authority, is unsuitable or deleterious. However, material containing stones up to 200 mm as their greatest dimension may be used in zone C unless otherwise specified herein.

9.3.1 *Backfill Sand*

Sand used for backfill shall be natural sand complying with **9.3**, graded from fine to coarse. The total mass of loam and clay in it shall not exceed 10 percent. All material shall pass through a sieve of 20 mm aperture size [*see* IS 2405 (Part 1)] and not more than 5 percent shall remain on an IS sieve of aperture size 6.30 mm.

9.4 Backfilling in Freezing Weather

Backfilling shall not be done in freezing weather except by permission of the Authority, and it shall not be made with frozen material. No fill shall be made where the material already in the trench is frozen.

9.5 Procedure

9.5.1 Backfilling in zone A shall be done by hand with sand, fine gravel or other approved material placed in layers of 80 mm and compacted by tamping. The backfilling material shall be deposited in the trench for its full width of each side of the pipe, fittings and appurtenance simultaneously.

9.5.2 Backfilling in zone B shall be done by hand or approved mechanical methods, special care being taken to avoid injuring or moving the pipe. The type of backfill material to be used and the method of placing and consolidating shall be prescribed by the authority to suit individual locations.

9.5.3 Backfilling in zone C shall be done by hand or by approved mechanical methods. The type of backfill material and method of filling shall be as prescribed by the authority. Unless otherwise specified, backfilling by hand shall be done in layers of 300 mm, each layer well compacted before laying the next layer.

9.6 Backfill Under Permanent Pavement

Where the excavation is made through permanent pavements, curbs, paved footpaths or where such structures are under-cut by the excavation, the entire backfill to the sub-grade of the structures shall be made with materials recommended and in accordance with **9.5.3**. Paved footpaths and pavements consisting of water bound macadam, gravel, slag or cinder shall not be considered as being of a permanent construction.

9.7 Backfill with Excavated Material

The excavated material may be used for backfill in the following cases, provided it complies with **9.3**.

a) In zone C, in cases where settlement is unimportant.

b) In any zone when the type of backfill material is not indicated or specified provided that such material consists of loam, clay, sand, fine gravel or other materials which are suitable for backfilling in the opinion of the authority.

9.8 Concrete Slabs Over Pipes

When pipes are laid under roads and pavements subjected to heavy traffic loads, the trenches may be covered with reinforced concrete slabs of suitable dimensions.

9.9 Surface Finish

In refilling, the fill shall be made 25 mm higher per 300 mm depth of trench subject to a maximum of 75 mm than the adjacent ground surface as the refill will settle with time, and it is most undesirable that this settlement should form a depression above the pipe.

10 REMOVAL AND RESTORATION OF PAVED FOOTPATHS, ETC, AFTER LAYING OF PIPE

10.1 Allowable Removal of Pavement

Pavement and road surfaces may be removed as a part of the trench excavation, and the amount removed shall depend upon the width of trench specified for the installation of the pipe and the width and length of the pavement area required to be removed for laying of stoneware pipes. The width of pavement removed along the normal trench for the installation of the pipe shall not exceed the width of the trench specified by more than 150 mm on each side of the trench. Wherever, in the opinion of the authority, existing conditions make it necessary or advisable to remove additional pavement, it shall be removed as directed by the authority.

10.2 Restoration of Damaged Surfaces and Property

Where any pavement, shrubbery, fences, poles or other property and surface structures have been damaged, removed or disturbed during the course of work, such property and surface structures shall be replaced or repaired after completion of work.

10.3 Replacement of Pavement and Structures

All pavements, paved footpaths, kerbing, gutters, shrubbery, fences, poles rod or other property and surface structures removed or disturbed as a part of the work shall be restored to a condition equal to that before the work began, furnishing all labour and material incidental thereto. In restoring the pavement, sound materials may be re-used. No permanent pavement shall be restored unless and until, in the opinion of the authority the condition of the backfill is such as to properly support the pavement.

10.4 Cleaning Up

All construction materials, and all tools and temporary structures shall be removed from the site as directed by the authority. All dirt, rubbish and excess earth from the excavation shall be hauled to a dump and the construction site left clean to the satisfaction of the authority.

ANNEX A

[*Clauses* 5.3 (d) *and* 6.11]

STRENGTH AND LOADING OF PIPES

A-1 LOAD CALCULATIONS

A-1.1 The superimposed load should not normally exceed 1 600 kg per metre length, which is the minimum crushing strength specified in IS 651. The superimposed load on a laid pipe may be calculated by Marston's formula, given below:

$$W = CwB^2$$

where

W = load on pipe, in kilogram/linear metre;

C = coefficient which depends upon the ratio of depth of trench to the trench width and the filling materials (*see* Table 1);

w = weight of filling materials, in kg/m^3 (*see* Table 2); and

B = width of trench, in metres.

$$W = CwB^2$$

Table 1 Value of '*C*'

(*Clause* A-1.1)

Sl No.	Ratio of Depth to Trench Width	Sand and Damp Topsoil	Saturated Topsoil	Damp Clay	Saturated Clay
(1)	(2)	(3)	(4)	(5)	(6)
i)	0.5	0.46	0.46	0.47	0.47
ii)	1.0	0.85	0.86	0.88	0.90
iii)	1.5	1.18	1.21	1.24	1.28
iv)	2.0	1.46	1.53	1.56	1.62
v)	2.5	1.70	1.76	1.84	1.92
vi)	3.0	1.90	1.98	2.08	2.20
vii)	3.5	2.08	2.17	2.30	2.44
viii)	4.0	2.22	2.33	2.49	2.66
ix)	4.5	2.34	2.47	2.65	2.87
x)	5.0	2.45	2.59	2.80	3.03
xi)	5.5	2.54	2.69	2.93	3.19
xii)	6.0	2.61	2.78	3.04	3.33
xiii)	6.5	2.68	2.86	3.14	3.46

Table 1 (*Concluded*)

Sl No.	Ratio of Depth to Trench Width	Sand and Damp Topsoil	Saturated Topsoil	Damp Clay	Saturated Clay
(1)	(2)	(3)	(4)	(5)	(6)
xiv)	7.0	2.73	2.93	3.22	3.57
xv)	7.5	2.78	2.98	3.30	3.67
xvi)	8.0	2.81	3.03	3.37	3.76
xvii)	8.5	2.85	3.07	3.42	3.85
xviii)	9.0	2.88	3.11	3.48	3.92
xix)	9.5	2.90	3.14	3.52	3.98
xx)	10.0	2.92	3.17	3.56	4.04
xxi)	11.0	2.95	3.21	3.63	4.14
xxii)	12.0	2.97	3.24	3.68	4.22
xxiii)	13.0	2.99	3.27	3.72	4.29
xxiv)	14.0	3.00	3.28	3.75	4.34
xxv)	15.0	3.01	3.30	3.77	4.38
xxvi)	Very great	3.03	3.33	3.85	4.55

Table 2 Masses of Common Filling Materials

(*Clause* A-1.1)

Sl No.	Material	Weight kg/m^3
(1)	(2)	(3)
i)	Dry sand	1 600
ii)	Ordinary (damp sand)	1 840
iii)	Wet sand	1 920
iv)	Damp clay	1 920
v)	Saturated clay	2 080
vi)	Saturated topsoil	1 840
vii)	Sand and damp soil	1 600

A-1.2 The load imposed on the pipe due to surface (traffic) loads may be found in accordance with the procedure given in **5** of IS 783.

A-2 MEASURES TO ACHIEVE HIGHER LOADING

A-2.1 Wherever the pipes have to be laid at such depths that the superimposed load on the pipe exceeds the safe crushing strength of 1 600 kg/m^2, protection may be provided by use of the methods given below:

a) Bedding, haunching, surround or encasing the pipe as described in **5.1, 5.2** and **5.3** respectively.

b) Wooden struts may be fixed horizontally near the mid-depth of the trench at suitable intervals to distribute a portion of the load to the two side walls of the trench as shown in Fig. 5.

c) Any other method, as recommended by the authority.

A-2.2 Whenever protection to pipes is provided by the use of any of the methods described under **A-2.1 (a)**, the minimum crushing strength of pipes is also increased. In case of 'bedding type' the actual crushing strength may be computed by multiplying the minimum crushing strengths by a load factor ranging from 2.25 to 3.37 as felt suitable by the Authority. In the case of encasing, the arch action of the concrete is the deciding factor for the strength of pipe.

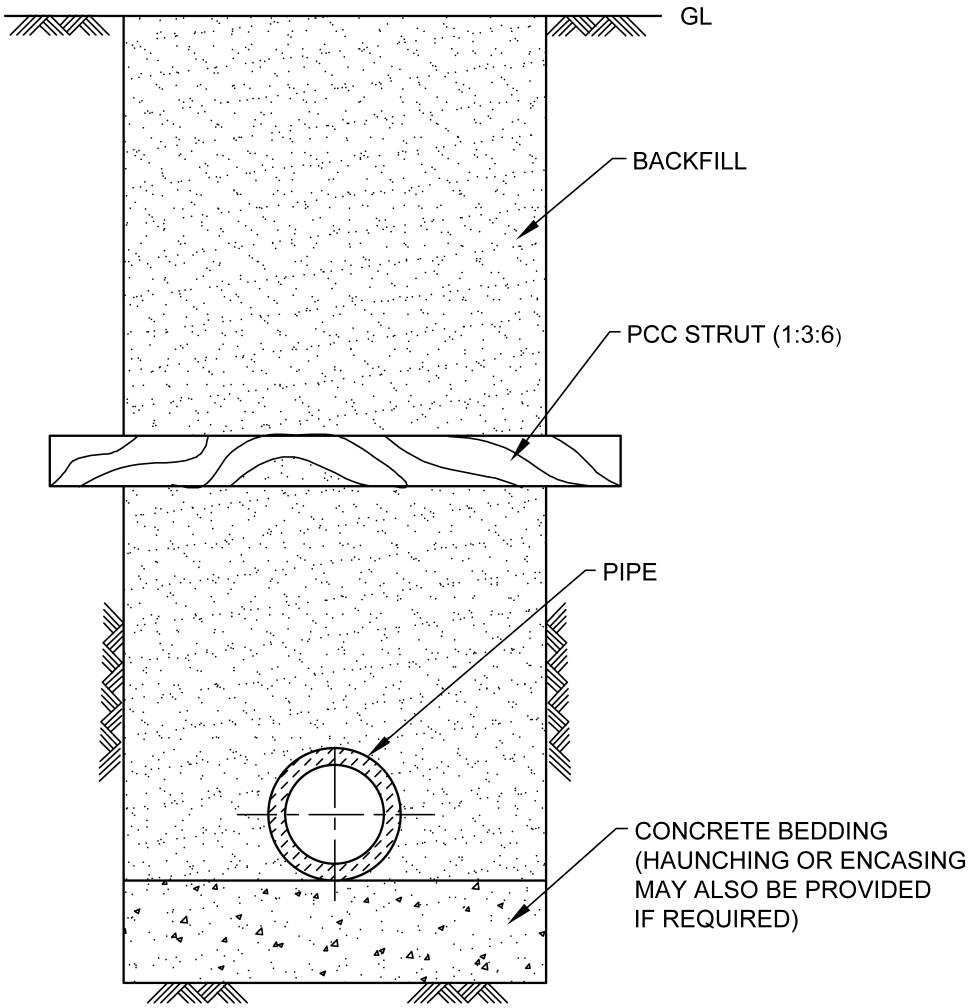


FIG. 5 FIXING OF PCC STRUTS IN DEEP TRENCHES

ANNEX B

(*Clause* 8.2)

HYDRAULIC TESTING OF STONEWARE PIPE SEWER LINES

B-1 METHODS OF TEST

B-1.1 The sewer testing plug is inserted at the upstream and downstream end and also in the various house service tappings and plugged. The testing plug comprises of two flanges, one rubber ring, wing nut, etc as shown in Fig. 6.

B-1.2 The plug is inserted at the upstream end and the lock is obtained by expanding the ring against the pipe wall by tightening the wing nut. To build up the necessary compressive force to cause expansion of the rubber ring, a roller washer is used.

B-1.3 Water for filling in is let through the funnel connected to the plug provided at the upstream end. To allow the air to escape a small hole is made on the pipe wall at the upstream end and after filling the pipe completely the hole is plugged with a wooden plug wound with hemp.

B-1.4 The downstream end of the sewer and all slants in the sewer line (provided for house service) are plugged with the sewer testing plug and capped.

B-1.5 The funnel is kept at a height of 25 mm from the invert of the sewer duly filled with water.

B-1.6 The pipeline is considered sound if the water in the funnel does not empty within 30 min.

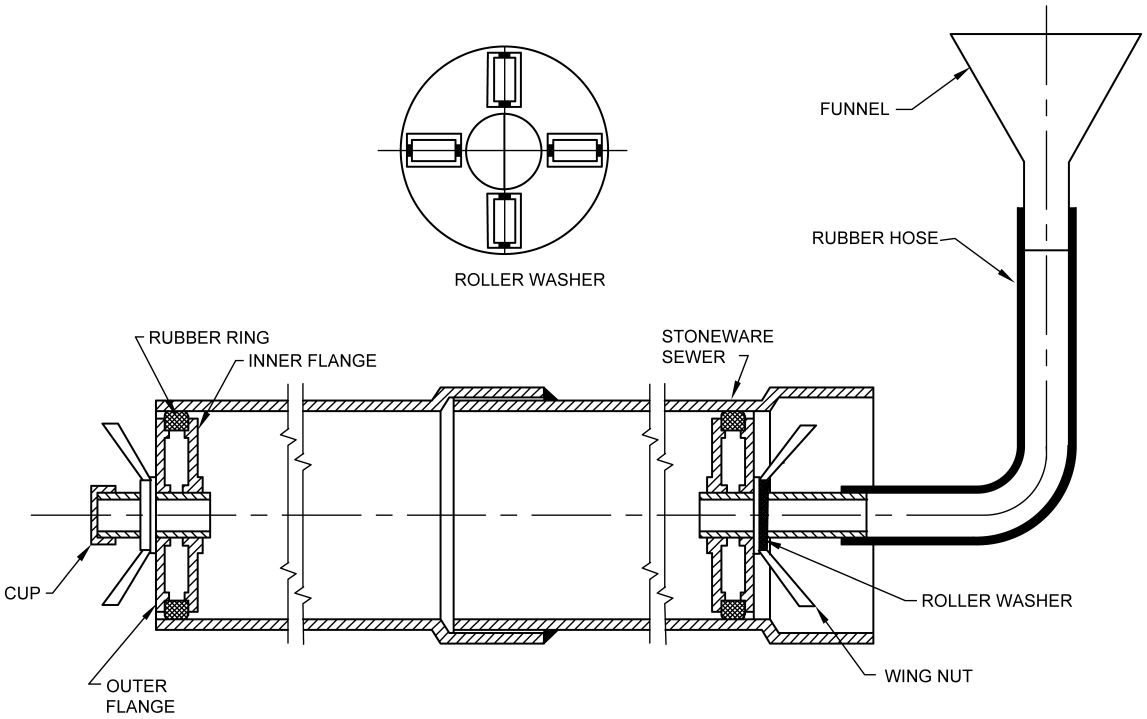


FIG. 6 TYPICAL ARRANGEMENT FOR HYDRAULIC TEST OF SEWERS

ANNEX C

(*Foreword*)

COMMITTEE COMPOSITION

Public Health Engineering Sectional Committee, CED 24

Organization	*Representative(s)*
In Personal Capacity (*840, Sector 17*, *Faridabad - 121002*)	SHRI A. K. SARIN **(*Chairperson*)**
Bangalore Water Supply & Sewerage Board, Bengaluru	SHRI B. R. NAGENDRA SHRI GURUPRASSAD BAILY (*Alternate*)
Brihan Mumbai Licensed Plumbers Association, Mumbai	SHRI KISHOR MERCHANT SHRI BIJAL M. SHAH (*Alternate*)
Bureau of Design (BODHI), Water Resources Department Government of Madhya Pradesh, Bhopal	REPRESENTATIVE
Central Pollution Control Board, New Delhi	SHRI P. K. MISHRA
Central Public Health & Environment Engineering Organization, New Delhi	SHRI V. K. CHAURASIA SHRIMATI K. SRAVANTHI JEEVAN (*Alternate*)
Central Public Works Department, New Delhi	SHRI M. K. MALLICK SHRI DIVAKAR AGRAWAL (*Alternate*)
CSIR - Central Building Research Institute, Roorkee	DR NEERAJ JAIN DR SOUMITRA MAITY (*Alternate*)
CSIR - National Environmental Engg Research Institute, Nagpur	DR S. K. GOYAL DR SUNITA SHASTRY (*Alternate*)
Defence Research and Development Organization, New Delhi	SHRI DEVAKANTA PAHAD SINGH DR K. P. MISHRA (*Alternate* I) DR ANURAG PANDEY (*Alternate* II)
Delhi Development Authority, New Delhi	MS HARLEEN BEHL SHRI RAVINDER KUMAR (*Alternate*)
Delhi Jal Board, New Delhi	SHRI VIKRAM SINGH SHRI S. L. MEENA (*Alternate*)
Delhi Technology University, New Delhi	DR VIJAY K. MINOCHA
Engineers India Ltd, New Delhi	SHRI D. C. BRAHMA SHRI ATULYA RANJAN (*Alternate* I) SHRIMATI RASHMI CHATURVEDI (*Alternate* II)
Gujarat Water Supply & Sewerage Board, Ahmedabad	SHRI P. G. GADANI SHRI R. B. SHETH (*Alternate*)
Indian Institute of Technology (BHU) Varanasi, Varanasi	DR GOUTAM BANERJEE DR D. MOHAN (*Alternate*)

Organization	*Representative(s)*
Indian Institute of Technology Delhi, New Delhi	DR B. J. ALAPPAT DR K. N. JHA (*Alternate*)
Indian Institute of Technology Roorkee, Roorkee	DR C. S. P. OJHA DR A. A. KAZMI (*Alternate*)
Indian Institute of Science Bengaluru, Bengaluru	REPRESENTATIVE
Indian Plumbing Association, New Delhi	SHRI H. R. RANGANATH
Indian Plumbing Skill Council, New Delhi	SHRI VINAY GUPTA SHRI ROHIT KUMAR SAHA (*Alternate*)
Indian Water Works Association, New Delhi	SHRI PRAMOD KUMAR SINHA SHRI ANIL KUMAR GUPTA (*Alternate*)
Institution of Public Health Engineers, Kolkata	SHRI ASIT NEMA SHRI YOGESH SHARMA (*Alternate*)
Jal Jeevan Mission, Ministry of Jal Shakti, New Delhi	REPRESENTATIVE
Jindal Saw Ltd, New Delhi	SHRI MANEESH KUMAR SHRI RAJEEV RANJAN (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, Integrated HQ of MoD (Army), New Delhi	SHRI RAJIV KHARE COL SUMEET SINGH MAKKAR (*Alternate*)
MKG Consultants, New Delhi	SHRI M. K. GUPTA SHRI NISHANT GUPTA (*Alternate* I) SHRI SHASHANK MOHAN TRIVEDI (*Alternate* II)
Municipal Corporation of Brihan, Mumbai	SHRI ASHOK S. TAVADIA SHRI S. D. WANI (*Alternate*)
National Institute of Technology, Patna	DR NITYANAND SINGH MAURYA
Proion Consultants Pvt Ltd, New Delhi	SHRI SANDEEP GOEL SHRI MANVEER SINGH (*Alternate*)
Public Health Engineering, Deapartment of Haryana, Panchkula	REPRESENTATIVE
Saviram Engineering Consultants Pvt Ltd, Noida	SHRI GIRISH CHANDRA MISHRA
Shreshtha Consultants, Jaipur	SHRI SUDHIR MATHUR
Tata Consulting Engineers Ltd, Mumbai	SHRI N. P. RAO SHRI DHEERAJ KAUSHIK (*Alternate*)
The Institution of Engineers, Kolkata	SHRI DINESH KUMAR MS NIKITA (*Alternate*)
Water and Power Consultancy Services India (WAPCOS), New Delhi	SHRI SANJAY VERMA

Organization	*Representative(s)*
In Personal Capacity (*Flat No. 12, Sanket Bhawani, Shankar Road, Mumbai - 400028*)	SHRI A. S. GUPTE
In Personal Capacity (*Flat 112, United Apartments, Plot 34, Sector - 4, Dwaraka, New Delhi - 110075*)	SHRI VINAYAK KOUNDANYA
In Personal Capacity (*34, PG Enclave, City Centre, Gwalior - 474011*)	DR LOKENDRA SINGH
BIS Directorate General	SHRI ARUNKUMAR S., SCIENTIST 'E'/DIRECTOR AND HEAD (CIVIL ENGINEERING) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretaries
SHRIMATI MADHURIMA MADHAV
SCIENTIST 'D'/JOINT DIRECTOR
(CIVIL ENGINEERING), BIS
AND
SHRI SHUBHAM AGRAWAL
SCIENTIST 'B'/ASSISTANT DIRECTOR
(CIVIL ENGINEERING), BIS

Working Group

Organization	*Representative(s)*
Brihan Mumbai Licensed Plumbers' Association, Mumbai	SHRI H. G. GANDHI
Delhi Jal Board, New Delhi	SHRI VIKRAM SINGH
Municipal Corporation of Greater Mumbai, Mumbai	SHRI S. R. ARGADE

This Page has been Intentionally left blank

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Head (Publication & Sales), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

This Indian Standard has been developed from Doc No.: CED 24 (18268).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	2323 7617
Eastern	: 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	2367 0012 2320 9474
Northern	: Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019	265 9930
Southern	: C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113	2254 1442 2254 1216
Western	: Plot No. E-9, Road No.-8, MIDC, Andheri (East), Mumbai 400093	2821 8093

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. CHANDIGARH. CHENNAI. COIMBATORE. DEHRADUN. DELHI. FARIDABAD. GHAZIABAD. GUWAHATI. HIMACHAL PRADESH. HUBLI. HYDERABAD. JAIPUR. JAMMU & KASHMIR. JAMSHEDPUR. KOCHI. KOLKATA. LUCKNOW. MADURAI. MUMBAI. NAGPUR. NOIDA. PANIPAT. PATNA. PUNE. RAIPUR. RAJKOT. SURAT. VISAKHAPATNAM.

Published by BIS, New Delhi